Technical Note

on

Methodology for Price Analysis and Forecasting

[Adopted by Market Intelligence Cell (MIC)]

The principal functions of the Market Intelligence Cell are (a) to analyse agricultural prices, (b) to make short term (monthly/quarterly/annual) forecasts of prices and (c) to disseminate price and market information to farmers and other stake-holders. The overall objective of these functions is to enable farmers to take rational decisions on production (which commodities to produce) and marketing (when and where to market), take price risk mitigation measures like forward sale, entering futures markets, hedging and options trading (wherever available). This information is also expected to be useful to Risk Mitigation Cell (RMC) for designing its actions, and to State Government for planning its interventions (like procurements, warehousing, release of stocks, etc.).

The present note explains the methodology adopted by MIC in analysing prices and making forecasts.

Sources of Data

The major source of price information used by MIC is the website of Agmarknet (https://agmarknet.gov.in/). This is the portal of Directorate of Marketing and Inspection (DMI), under the Ministry of Agriculture & Farmers Welfare, Government of India. The website provides daily arrivals and prices of agricultural commodities sold in the markets supervised by the Agricultural Produce Market Committees (APMCs) in India. The portal covers more than 3400 such markets and around 309 commodities. (See Map 1 and Chart 1).

These markets are spread throughout the country. Farmers bring their produce to these markets and sell it through auctions to the traders, wholesalers, processors, etc. The auctions and other market practices are supervised by the APMCs, who relay the information on prices and arrivals to the Agmarknet portal daily, generally on the same trading day. This data is available from 2001 onwards. APMCs are spot markets and the prices ruling in these markets are spot prices. The portal reports daily, for each commodity, total arrivals, maximum price, minimum price and modal price (that is, the price at which maximum quantity is sold). The quantity sold in APMCs as proportion of production varies from commodity to commodity and over time. At present, for most commodities it is between 30 to 60 per cent (A note on the subject is under preparation).

This data (on prices and arrivals) is also available for APMCs in Maharashtra on the website of the Maharashtra State Agricultural Marketing Board (MSAMB) (https://www.msamb.com/ApmcDetail/APMCPriceInformation). The individual APMCs have this data along with information on the buyers in their records.

Some of the other sources for price information used by MIC include Agricultural and Processed Food Products Export Development Authority (APEDA, https://apeda.gov.in/apedawebsite/), National Horticultural Board (https://apeda.gov.in/apedawebsite/), wholesale price indices for agricultural commodities published monthly by the Office of the Economic Adviser, Government of India (https://eaindustry.nic.in/); National Commodity and Derivatives Exchange (NCDEX), Multi-commodity Exchange (MCX) (for futures prices), and United States Department of Agriculture (USDA), and FAO (for international prices).

The data on agricultural acreage, production and yield for the agricultural commodities is collected from the Government sources (both Central and State), USDA, FAO, Commodity Associations, etc. The data on foreign trade and foreign exchange rates is similarly collected from the Government and other published sources. The data on utilization, stocks and consumption is rather limited; whatever that is available from sources like National Sample Surveys is collected and used in the analysis. The data on National Income, Population, Minimum Support Prices, procurement, distribution, and Government policies is compiled from the Government Sources.

MIC has put in place the system for collecting, verifying and compiling into time series data from these sources. The market-wise data on prices and arrivals are converted into daily, weekly, monthly, quarterly and annual time series. The trade data is converted into monthly and the data on production, availability, consumption, per capita income, etc. is used as annual time series.

Map 1: Markets covered by Agmarknet (3,414)

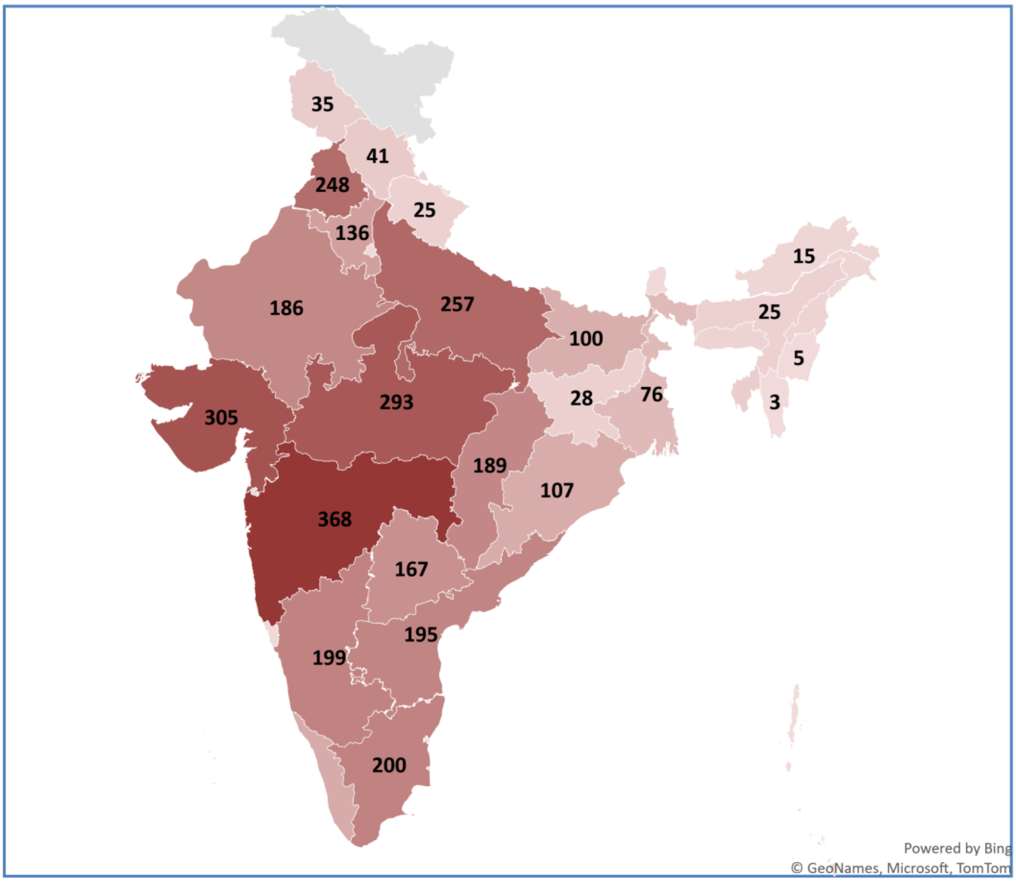

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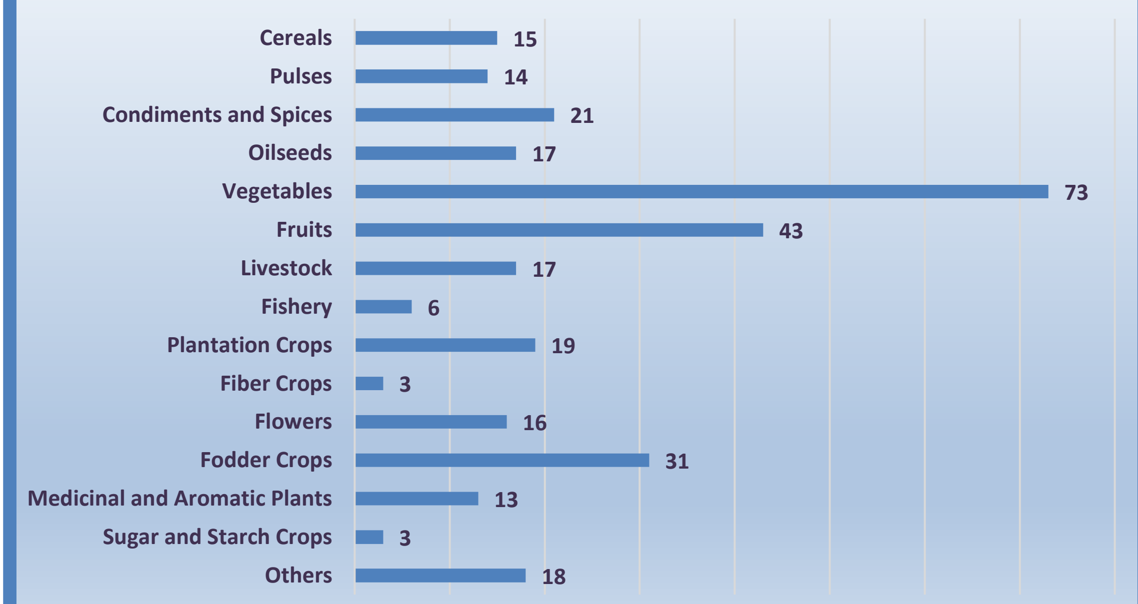
Chart 1: Number of Commodities covered by AGMARKNET (Total: 309)



Analysis of Data

The Price data is analysed to provide information on:

1. Extent of Market Integration (whether prices in different markets follow similar patterns over a long period of time).
2. Differences in prices in different markets and the factors influencing them
3. Extent of Seasonality in prices, changes in them over time and factors influencing them
4. Extent of long-term increase (or decrease) in price trends and factors affecting them .
5. Presence of periodic cycles in prices and factors leading to them
6. Volatility in prices and changes in it over time; measuring risk to farmers; examining spikes and their sudden occurrences
7. Effect of interventions like minimum support price, imports, exports and public distribution on prices
8. Effects of Futures prices on spot prices and on the volatility in prices

The analysis is conducted by tabulation, charts, maps and other visual tools, and using statistical tools like descriptive measures, correlation, regression, dynamic regression involving cointegration approach, Granger casualty and Ravallion criteria (for Market Integration), de-composition and X-13 method of US Department of Census (for seasonality, trend and cycle analysis).

The chief objective of this analysis is to provide advisories to farmers on which markets should be preferred, what price differences among markets to expect, how the cropping decisions should be taken, extent of seasonality in prices and arrivals, and commodities showing significant risks of speculative nature. The advisories to the Governments include price monitoring dashboards, suggestions on procurement and other interventions, etc. Some specific analytical studies will also be conducted on on-request basis. This analysis is also expected to support the activities of the Risk Mitigation Cell.

The results of the analysis are presented by way of weekly and monthly bulletins and dashboards. The commodity-wise monthly reviews will be published from January 2023;

Forecasting of prices

The commodity-wise forecasts are prepared for selected markets in Maharashtra for each quarter: October – December, January – March, April – June and July – September. The markets are selected on the basis of quantum of arrivals and the number of days for which price data is available. One market is selected for each commodity for forecast. The first forecast is prepared in June (for October – December Quarter), in October (for January – March Quarter), in January for (April – June Quarter) and in April (for July – September Quarter). These forecasts are revised monthly in subsequent months.

The forecasts are made quantitatively by MIC and then verified subjectively by outside traders and experts.

The quantitative forecasting models used for this purpose include:

1. Econometric Models like bivariate and multi-variate regression equations. The typical models like price as a function of climate, availability, stocks, international prices, prices of substitute commodities, consumption, income, secular trend, etc. fall in this category. The Models are linear as well as non-linear. They could be single equation or simultaneous equation models. Although most of these models are useful for making annual or long-term forecasts, econometric models for quarterly prices with inclusion of independent variables like climate, arrivals, international prices, Government policies/interventions, etc. are also found to be useful. Special types of models for explaining (and, if possible, for predicting) shifts and spikes are being explored. Influence of rainfall on the yield and prices of commodities is explored by developing commodity-wise rainfall indices. The preliminary results are encouraging.
2. Univariate time-series models like Simple and Holt Winter’s Exponential Smoothing, and Seasonal Autoregressive Integrated Moving Average (SARIMA) are currently being used for forecasting. These are accompanied by the Dynamic Regression Models. The Models based on Machine Learning and Artificial Intelligence (AI) will be added to the portfolio after the necessary training to the existing staff and fresh recruitment.

For making forecasts, the industry standard tool of X13-SEATS-ARIMA is used for decomposition (separating seasonality, trend and cycles) and forecasting. It is available, along with other forecasting tools described above, in software platforms like R, Gretl and E-views. The present staff is trained in using these platforms. Plans are also in progress for further capability building of the staff in using Python for Machine Learning methods of forecasts.

For a given price series, several quantitative forecasts are prepared by using different methods and the forecasts are selected on the basis of minimum forecasting errors. The selected forecasts are then discussed with the market functionaries and industry experts and finally presented before the Committee, specially appointed for the purpose. After its approval, they are released.

As stated earlier, all forecasts are reviewed, and if necessary, revised every month.

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